

We Claim:

1. A system for discerning an audible command from ambient noise in a vehicular cabin, the system comprising:

5 a microphone array; and

a signal processing system.

2. The system of claim 1, wherein the microphone array is one-dimensional.

3. The system of claim 1, wherein the microphone array is two-dimensional.

10 4. The system of claim 1, wherein the microphone array is three-dimensional.

5. The system of claim 1, wherein the microphone array is pivotally mounted in the vehicular cabin.

15 6. The system of claim 1, wherein the vehicular cabin includes a rearview mirror, and the microphone array is located within the mirror.

20 7. The system of claim 6, including means for determining the position of the mirror.

8. The system of claim 7, wherein the position determining means comprises a potentiometer.

25 9. The system of claim 1, wherein the vehicular cabin includes a headliner, and the microphone array is located within the headliner.

10. The system of claim 1, wherein the vehicular cabin includes a overhead console, and the microphone array is located within the overhead console.

11. The system of claim 1, wherein the vehicular cabin includes an interior surface, and the microphone array is located within the interior surface.

12. The system of claim 1, wherein the vehicular cabin includes a dashboard, and the microphone array is located within the dashboard.

13. The system of claim 1, wherein the vehicular cabin includes a visor, and the microphone array is located within the visor.

10 14. The system of claim 1, wherein the vehicular cabin includes a pillar, and the microphone array is located within the pillar.

15 15. The system of claim 1, wherein the vehicular cabin includes a headrest, and the microphone array is located within the headrest.

16. The system of claim 1, wherein the vehicular cabin includes a steering wheel, and the microphone array is located within the steering wheel.

20 17. The system of claim 1, wherein the vehicular cabin includes a compartment door, and the microphone array is located within the compartment door.

18. The system of claim 1, wherein the signal processing system is analog.

25 19. The system of claim 18, wherein the analog signal processing system performs a delay and sum processing function.

20. The system of claim 18, wherein the analog signal processing system performs a filter and sum processing function.

30 21. The system of claim 1, wherein the signal processing system is digital.

22. The system of claim 21, wherein the digital signal processing system performs Griffiths Jim processing.

5 23. The system of claim 21, wherein the digital signal processing system performs Frost processing.

24. The system of claim 21, wherein the digital signal processing system performs adaptive signal processing.

10 25. The system of claim 21, wherein the digital signal processing system performs adaptive beamforming.

15 26. The system of claim 25, wherein the digital signal processing system performs adaptive noise reduction.

27. The system of claim 1, wherein the signal processing system is acoustic.

20 28. The system of claim 27, wherein the acoustic signal processing system includes a delay line.

29. The system of claim 27, wherein the acoustic signal processing system is shotgun.

30 30. The system of claim 1, including a plurality of microphone arrays.

25 31. The system of claim 1, wherein the signal processing system includes multiple output channels.

30 32. The system of claim 1 wherein the microphone array is directional.

33. The system of claim 32, wherein the direction of the directional microphone array is adjustable.

5 34. The system of claim 32, wherein the direction of the directional microphone array is electronically adjustable.

10 35. The system of claim 34, including means for maximizing the directionality of the directional microphone relative to the audible command.

36. The system of claim 32, wherein the direction of the directional microphone array is mechanically adjustable.

15 37. The system of claim 1, wherein the microphone array includes silicon based microphones.

38. The system of claim 1, wherein the vehicle has a controllable parameter, and the system includes means responsive to the audible command for controlling the parameter.

20 39. The system of claim 1, wherein the vehicle has a plurality of controllable parameters, and the system includes means responsive to the audible command for controlling a desired one of the parameters.

40. The system of claim 1, including means for detecting failure of one microphone of the microphone array.

25 41. The system of claim 40, including means responsive to the failure detection for compensating for the failure of the microphone.

30 42. The system of claim 1, wherein the microphone array is selectively directional between two potential audible command sources.

43. The system of claim 1, including means responsive to the audible command for controlling a vehicular function.

44. A system for discerning an audible command of a speaker from ambient noise in a vehicular cabin, the system comprising:

5 a microphone array having an output; and
a signal processing system coupled to the output of the array for forming a microphone beam.

10 45. The system of claim 44, wherein the signal processing system includes means for adaptively adjusting the microphone beam.

15 46. The system of claim 45, wherein the signal processing system includes means for locating the speaker.

20 47. The system of claim 46, wherein the signal processing system includes means for defining an acceptance area about the located speaker.

25 48. The system of claim 47, wherein the signal processing system includes means for adjusting the acceptance area.

49. A system for discerning an audible command of each of two speakers from ambient noise in a vehicular cabin, the system comprising:

25 a microphone array having an output; and
a signal processing system coupled to the output of the array for forming two microphone beams, one associated with each of the speakers.

30 50. The system of claim 49, wherein the signal processing system has two outputs, one associated with each of the formed beams.

51. The system of claim 49, wherein the signal processing system includes means for locating each of the speakers.

52. The system of claim 51, wherein the signal processing system includes means for defining an acceptance area about each of the located speakers.

53. The system of claim 52, wherein the signal processing system includes means for adjusting each of the acceptance areas.

10 54. The system of claim 49, including means for toggling between each of the beams.

15 55. The system of claim 49, including means responsive to the audible command for controlling a vehicular function.

56. A system for controlling a vehicular function in response to an audible command, the system comprising:

a microphone array disposed within a rear-view mirror, the rear-view mirror being disposed within a vehicular cabin;

20 a signal processing system coupled to the microphone array for discerning the audible command from ambient noise in the vehicular cabin; and

means responsive to the audible command for controlling the vehicular function.

25 57. The system of claim 56, including means for locating the speaker.

58. The system of claim 57, wherein the signal processing system includes means for defining an acceptance area about the located speaker.

30 59. The system of claim 57, wherein the signal processing system includes means

for adjusting the acceptance area.

60. A system for controlling a vehicular function in response to an audible command, the system comprising:

5 a microphone array disposed within a headliner, the headliner being disposed within a vehicular cabin;

a signal processing system coupled to the microphone array for discerning the audible command from ambient noise in the vehicular cabin; and

10 means responsive to the audible command for controlling the vehicular function.

61. The system of claim 60, including means for locating the speaker.

15 62. The system of claim 61, wherein the signal processing system includes means for defining an acceptance area about the located speaker.

63. The system of claim 62, wherein the signal processing system includes means for adjusting the acceptance area.

20 64. A system for discerning an audible command from ambient noise in a vehicular cabin, the system comprising:

a plurality of microphone arrays; and

a signal processing system coupled to the arrays for forming a microphone beam.

25 65. The system of claim 64, wherein the signal processing system includes means for adaptively adjusting the microphone beam.

66. The system of claim 65, wherein the signal processing system includes means for locating the speaker.

67. The system of claim 66, wherein the signal processing system includes means for defining an acceptance area about the located speaker.

68. The system of claim 67, wherein the signal processing system includes means for adjusting the acceptance area.

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